

## ***In Vivo* Effect of Endrin on Three Phosphatases in Kidney and Liver of the Fish *Ophiocephalus punctatus***

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The liberal use of pesticides on agricultural pests often causes damage to aquatic life also. A number of workers have reported toxicity of organo-chlorine pesticides to fishes. MOUNT (1962) observed that endrin affected under chronic conditions the central nervous system and reproductive system of both bluntnose minnows, Pimephales notatus and guppies, Lebistes reticulatus. FERGUSON et al. (1970), SAANIN (1960) and TARZWELL (1965) have reported that endrin in water is highly toxic to fishes.

EISLER and EDMUNDS (1966) observed that northern puffers (Sphaeroides maculatus) exposed acutely to sublethal concentrations of endrin had impaired liver function, as evidenced by the transfer of major cations from the hepatic tissue into the serum and by elevated serum cholesterol. GRANT and MEHRLE (1970) reported altered physiologic parameters of growth, reproduction, thyroid activity, intermediary metabolism and osmoregulation in goldfish, Carassius auratus chronically exposed to endrin by diet. ELLER (1971) observed that endrin by bath or in food caused hyperplasia of the islets of Langerhans and altered carbohydrate metabolism. JOHNSON (1968) and KATZ et al. (1969) reviewed the literature of the effects of various pesticides on fishes.

In the present study, the effect of endrin on the phosphatases of kidney and liver in Ophiocephalus punctatus has been examined.

### **MATERIALS AND METHODS**

Living fishes (varying 50 to 70 g in weight and 10 to 15 cm in length) were collected from local fresh water sources and stored in the laboratory in tapwater under constant conditions of nutrition and temperature. The control samples were placed in two glass aquaria, each containing ten liters of tap water. A fish density of one fish per liter was used with ten individuals per aquarium. In each case, twenty fishes

were used. In order to observe the effect of a sub-lethal concentration for a prolonged period, the fishes were treated with 0.030 mg/L. The fishes were allowed to acclimatize to the aquaria for two days prior to the introduction of insecticide.

After twenty days of treatment, the control and treated fishes were dissected and the kidney and liver were collected. 10% (W/V) homogenates were prepared in cold 0.25 M sucrose solution. The homogenates were centrifuged for 20 min at 1000 G and the supernatant clear fluids were used as the enzyme source. For acid and alkaline phosphatase, 0.016 M sodium  $\beta$ -glycerophate was used as the substrate in a pH medium of 5.0 and 9.3, respectively. The incubation time was one hr. The enzyme activity was estimated according to the method of BODANSKY (1933). Glucose-6-phosphatase activity is estimated adopting the method of SWANSON (1965). 0.010 M glucose-6-phosphate solution was incubated for 15 min at pH 6.5. All the incubations were at 37°C. The activity of the phosphatases is expressed as mg of inorganic phosphate liberated per mg of enzyme protein per hr. Protein was determined by the method of LOWRY et al. (1951) with bovine serum albumin as the standard.

## RESULTS

The results of the experiments conducted are given in Table 1.

From the Table, it is evident that in the kidney, the activities of the three phosphatases showed a slight increase. The most significant increase is in the activity of acid phosphatase. In the liver, an inhibition in the activities of alkaline phosphatase and glucose-6-phosphatase was noted but here also acid phosphatase activity was slightly stimulated.

## DISCUSSION

The effect of the pesticide endrin, on the activities of three phosphatases has been examined in the kidney and liver of a fresh water teleost fish, Ophiocephalus punctatus. Though a number of references are available on the toxicity and accumulation of this pesticide in fishes (FERGUSON et al. 1965, HENDERSON et al. 1969), very little work has been done on its effect on enzyme activities. It has been found here that endrin inhibited the activities of alkaline phosphatase and glucose-6-phosphatase in the liver but there is a slight stimulation of acid phosphatase activity. In the kidney, all the enzymes showed a slight increase in activity. Acid phosphatase is a lysosomal

TABLE 1

The activities of acid, alkaline and glucose-6-phosphatases in control and treated fishes. (Figures in parentheses represent numbers of experiments conducted, values are mean  $\pm$  SE).

Enzymes	Tissues				
	Kidney		Liver		
	Control	Treated (Sign.diff) <sup>t</sup>	Control	Treated	(Sign.diff.) <sup>t</sup>
Acid phosphatase (3)	0.0306 $\pm$ 0.0212	0.0673 $\pm$ 0.0373 (-)	0.0222 $\pm$ 0.0077	0.0285 $\pm$ 0.0062	(-)
Alkaline phosphatase (3)	0.0127 $\pm$ 0.0044	0.0162 $\pm$ 0.0027 (-)	0.0111 $\pm$ 0.0013	0.0715 $\pm$ 0.0025	(+)
Glucose-6-phosphatase (3)	0.0676 $\pm$ 0.0326	0.0920 $\pm$ 0.0220 (+)	0.1265 $\pm$ 0.0950	0.1115 $\pm$ 0.0680	(-)

Significant differences are indicated by (+). The 95 percent confidence interval was used in all 't' tests.

enzyme which helps in the autolysis of the cell after its death. Organochlorine compounds are known to exert chronic pathological conditions in various tissues (BHATTACHARYA et al. 1975, ELLER 1971, GRANT and MEHRLE 1970). The elevated acid phosphatase activity may be associated with the disintegration of the cells affected by endrin treatment. Alkaline phosphatase is a brush border enzyme present in both kidney and liver of Ophiocephalus (GOEL and SASTRY 1973, SASTRY 1975). In the kidney, there is no significant variation in the enzyme activity. But the activity is inhibited in the liver. As the liver is the primary organ of detoxication, the toxic effects are more conspicuous in the liver. Inhibition of alkaline phosphatase activity indicates a decrease in the transphosphorylation activity in this organ. Glucose-6-phosphatase occurs in the kidney and liver of fishes and is localized in the endoplasmic reticulum. The hydrolysis of glucose-6-phosphate is a keystone in gluconeogenesis and in the conversion of liver glycogen to blood glucose (HOCHACHAKA 1969). GRANT and MEHRLE (1973) have reported inhibition of mobilization of liver glycogen by low doses of endrin and blockage by high doses. It is reasonable to assume that similar condition existed in Ophiocephalus punctatus also as evidenced by the decrease in glucose-6-phosphatase activity.

#### SUMMARY

The effect of endrin (0.030 ppm) on the acid phosphatase, alkaline phosphatase and glucose-6-phosphatase activities in the kidney and liver of a teleost fish, Ophiocephalus (Channa) punctatus has been studied. The period of exposure was twenty days. An increase in the acid phosphatase activity is noted in the two tissues examined here. There is no significant change in the activity of alkaline phosphatase in kidney while in liver the enzyme is inhibited. In the kidney glucose-6-phosphatase showed a slight increase in activity but it is inhibited in liver.

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